Appendix I

Attainment Test

TABLE OF CONTENTS

LIST OF TABLES

TABLE 2.1-1……END

TABLE 2.1-2……END

ATTAINMENT DEMONSTRATION

This Appendix summarizes the procedures that were used to demonstrate attainment of the 8-hour ozone National Ambient Air Quality Standard (NAAQS) in this State Implementation Plan (SIP) package. As described in the US Environmental Protection Agency's (USEPA's) Guidance On The Use Of Models And Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, PM2.5, and Regional Haze ("*Attainment Guidance*"), an attainment demonstration consists of (a) analyses which estimate whether selected emissions reductions will result in ambient concentrations that meet the NAAQS, and (b) an identified set of control measures which will result in the required emissions reductions. The necessary emission reductions for both of these attainment demonstration components may be determined by relying on results obtained with air quality models.

Section 3.0 of the *Attainment Guidance* recommends applying both a modeled attainment test and a subsequent screening test to the air quality modeling results to determine if the 8-hour ozone NAAQS will be met. Additional technical or corroboratory analyses may also be used as part of a "weight of evidence" determination to supplement the modeled attainment test and to further support a demonstration of attainment of the NAAQS.

The modeled attainment test, additional corroborative analyses and weight of evidence, and unmonitored area analysis are described in further detail in the remaining portions of this Appendix, detailing how the respective test or analysis was performed and applied to the attainment demonstration.

1 MODELED ATTAINMENT TEST

The modeled attainment test is the practice of using an air quality model to simulate baseline (i.e., current) and future air quality. For the 8-hour ozone NAAQS, the baseline and future model estimates are used in a "relative" rather than "absolute" sense. Specifically, the ratio of the air quality model's future to baseline predictions is calculated at each ozone monitoring site. These monitoring site-specific ratios are called relative response factors (RRF). Future ozone design values (DVF) are then estimated at each monitor by multiplying the monitor-specific baseline ozone design value (DVB) by the modeled relative response factor for each monitor. If the resulting predicted site-specific DVFs are < 82 parts per billion (ppb), a clear demonstration of predicted attainment is shown. If the predicted DVFs is $\geq$ 82 ppb and $\leq$ 87 ppb, then weight of evidence must be submitted that supports a demonstration of attainment. For DVFs > 87ppb, the modeled attainment test is failed. Equation 2-1 presents the modeled attainment test, applied at monitoring site "x" as described in Section 4.0 of the *Attainment Guidance*.

$$(DVF) = (RRF) \times (DVB) \qquad \text{Equation 1-1}$$

Where (DVB) = the baseline design value monitored at site "x", ppb
= the average (of the three) design value periods which include the baseline inventory year (i.e. the average of the 2000-2002, 2001-2003, and 2002-2004 design vales periods for the 2002 baseline inventory year).

(RRF) = the ratio of the future 8-hr daily maximum concentration predicted "nearby" a monitor (averaged over each day of the episode) to the current 8-hr daily maximum concentration predicted "nearby" the monitor (averaged over each day of the episode).

(DVF) = the estimated future design value, ppb.

It is important to consider an array of cells "nearby" a monitor rather than focusing on the individual cell containing the monitor. This allows for variations in the model performance where the peak ozone may not occur in the grid cell that contains the monitor but rather nearby the monitor. Table 2-1 provides the USEPA's recommendations for defining "nearby" cells for grid systems having cells of various sizes.

Table 1-1 USEPA's Recommendation for Defining "Nearby" Cells

Size of Cell (km)	Size of the Array of "Nearby" Cells
$\leq$5	7 x 7
>5-8	5 x 5
>8-15	3 x 3
>15	1 x 1

The RRF is calculated by taking the ratio of the mean future year modeling 8-hour ozone daily maximum to the mean baseline year modeling 8-hour ozone daily maximum "near" the monitor. (Equations 2-2).

$$RRF = \frac{\text{mean future yr. 8-hr daily max "near" monitor "x"}}{\text{mean baseline yr. 8-hr daily max "near" monitor "x"}} \quad \text{Equation 1-2}$$

Section 14.1.1 of USEPA's *Attainment Guidance* outlines the process for determining which days are used in the RRF calculation. The day selection process starts by identifying all the days in the baseline modeling that has a modeled daily maximum 8-hour average ozone equal to or greater than 85 ppb. If there are 10 or more days greater than 85 ppb, then 85 ppb is used as the cutoff with those days used in the RRF calculation. If there are fewer than 10 days with a modeled daily maximum 8-hour average ozone equal to or greater than 85 ppb, then the threshold is reduced by 1 ppb until there are at least 10 days identified for use. If there are fewer than 10 days with a modeled daily maximum 8-hour average ozone equal to greater than 70 ppb, then all days at 70 ppb and higher are used in the RRF calculation and consideration of modeling another episode should be explored.

The DVB, for purposes of the modeled attainment test, is defined in the *Attainment Guidance* by one of four methods:

1. The design value period (i.e. the average 4th highest value for the 3-yr period used to designate an area "nonattainment", here the period from 2001 to 2003)

2. The average 4th highest value for the 3-yr period straddling the baseline inventory year (e.g., the 2001-2003 design value period for the 2002 baseline inventory year)

3. The highest of the three design value periods which include the baseline inventory year (e.g., the 2000-2002, 2001-2003, 2002-2004 design value periods for a 2002 baseline inventory year)

4. The average of the three design value periods which straddle the baseline inventory year (e.g., the average of the 2000-2002, 2001-2003, and 2002-2004 design value periods for a 2002 baseline inventory year)

The USEPA recommends the fourth method (average of the three design value periods straddling the baseline year), which is the DVB shown in Table 2-2 at each ozone monitoring site in the nonattainment region.

Table 1-2 lists the attainment test results for the Cincinnati-Hamilton OH-KY-IN 8-hour Ozone Nonattainment Area. The first column is the monitoring site, followed by the base year design value. The next series of columns are the calculated RRF and the resulting DVF for the attainment year 2009. Monitors with DVFs that fall in the additional weight of evidence requirement are bolded.

Table 1-2 Attainment Test Results

County	Monitor I.D.	DVB (ppm) 5-year weighted 2000-2004	2009	
			RRF	DVF (ppm)
Boone	21-015-0003	0.0841	0.870	0.072
Campbell	21-037-0003*	0.0912	0.908	**0.082**
Kenton	21-117-0007	0.0856	0.908	0.077
Butler	39-017-0004	0.0901	0.905	0.081
Butler	39-017-1004	0.0901	0.897	0.078
Clermont	39-025-0022	0.0896	0.907	0.081
Hamilton	39-061-0006	0.0910	0.898	0.081
Hamilton	39-061-0010	0.0863	0.905	0.077
Hamilton	39-061-0040	0.0864	0.918	0.078
Warren	39-165-0006**	0.0901	0.878	0.079
Warren	39-165-0007	0.0907	0.878	0.079

* This monitor was discontinued after the 2005 ozone season.

**This monitor was discontinued after the 2003 ozone season and became 0007 in 2004.

2 ADDITIONAL CORROBORATIVE ANALYSES AND WEIGHT OF EVIDENCE DETERMINATION

As part of the weight of evidence determination, the following analyses will be evaluated:

- Development of 2008 emissions inventory,
- Alternative DVFs calculations,
- Metrics of air quality modeling results,
- Air quality modeling results from other studies,
- Observed air quality trends and additional reductions in emissions, and

The weight of evidence determination is a supplement to the modeled attainment test and further supports that the area will attain the NAAQS for 8-hour ozone by June 15, 2008.

2.1 Development of 2008 emissions inventory

By letter dated March 27, 2006, a request was made to U.S. EPA to allow the use of 2009 modeling results for the development of attainment demonstrations. The reasoning behind this request was that when the Association for Southeastern Integrated Planning (ASIP) work was first envisioned, it was to address fine particulate ($PM_{2.5}$) attainment demonstration efforts. The work was focused in the states with $PM_{2.5}$ nonattainment areas already participating in the Visibility Improvement State and Tribal Association of the Southeast (VISTAS) regional haze state implementation plan (SIP) process. The states with basic ozone areas determined that it would be more efficient to also perform ozone season modeling for 2008 as part of the ASIP effort. At the time, the most recent ASIP model run for 2009 showed each of the existing 8-hour nonattainment areas to be in attainment. The states therefore proposed to use the 2009 modeling results and a weight of evidence approach to develop the attainment demonstrations for these areas in lieu of conducting 2008 modeling for these areas. This was approved in an e-mail dated May 9, 2006 (see Appendix A). Emissions of VOC, CO, and NOx were developed for 2008 using the 2009 emissions inventory utilized by VISTAS for the modeling. The methodology for this development is as follows:

The ASIP modeling contractor provided KYDAQ with daily 2009 emissions, annual 2009 emissions, and 2008 annual emissions. The 2008 annual emissions were divided by 365 to come up with a 2008 daily emissions total.

Table 2.1-1 located at the end of Appendix I documents these calculations and their results.

Table 2.1-2 located at the end of Appendix I shows a comparison between the 2008 and 2009 emissions, the percentage difference and the absolute difference. For the entire nonattainment area, the percentage difference for VOC is seven one-hundredths of one percent (0.07%).

The percentage difference for NOx for the entire nonattainment area is less than fifteen percent (15%). This much higher percentage difference is attributable to the onset of the CAIR reductions as well as the earlier reductions due to the NOx SIP Call.

2.2 Alternative DVF Calculation

In the *Attainment Guidance*, the USEPA recommends calculating the DVB by averaging the three design value periods that straddle the baseline inventory year. This methodology results in a center weighting of annual 4th highest ozone concentrations around the baseline inventory year because the three design value periods averaged contain overlapping data. When simplified the recommended DVB calculation for this SIP modeling exercise can be seen in Equation 3.2-1

$$DVB = \frac{1*(2000\ 4^{th}\ \text{Highest}) + 2*(2001\ 4^{th}\ \text{Highest}) + 3*(2002\ 4^{th}\ \text{Highest}) + 2*(2003\ 4^{th}\ \text{Highest}) + 1*(2004\ 4^{th}\ \text{Highest})}{9} \quad \text{Equation 2.2-1}$$

The weighting scheme of annual 4th highest ozone concentrations in the recommended DVB calculation artificially weights the center, or third, year three times more than that of the first or last year and one and half times more than that of the second or forth year. If this third year is an abnormally hot/dry or cool/wet period, the unusual meteorological conditions and resulting abnormal air quality conditions will be amplified upward or downward in the modeled attainment exercise.

To minimize potential impacts of any abnormal meteorological conditions while still considering ozone conditions across a 5-year span, the KYDAQ has used an alternative DVB calculation that does not weight any of the years more than another. Quite simply, the KYDAQ alternative DVB calculation is a straight average of annual 4th highest ozone concentrations for the 5-year span centered on the baseline inventory year (Equation 3.2-2).

$$DVB = \frac{2000\ 4^{th}\ \text{Highest} + 2001\ 4^{th}\ \text{Highest} + 2002\ 4^{th}\ \text{Highest} + 2003\ 4^{th}\ \text{Highest} + 2004\ 4^{th}\ \text{Highest}}{5} \quad \text{Equation 2.2-2}$$

When the KYDAQ alternative DVB calculation is applied to the remainder of the Modeled Attainment Test equations, the resulting DVFs are shown in Table 3.2-1 at each monitoring site in the Cincinnati-Hamilton OH-KY-IN region.

Table 2.2 5-Year Average Alternative Attainment Test Results for 2009

County	Monitor I.D.	DVB 5-Year Straight Average 2000-2004 (ppm)	RRF	DVF (ppm)
Boone	21-015-0003	0.0816	0.870	0.071
Campbell	21-037-0003*	0.0888	0.908	0.080
Kenton	21-117-0007	0.0834	0.908	0.075
Butler	39-017-0004	0.0868	0.905	0.078
Butler	39-017-1004	0.0856	0.897	0.076
Clermont	39-025-0022	0.0874	0.907	0.079
Hamilton	39-061-0006	0.0876	0.898	0.078
Hamilton	39-061-0010	0.0836	0.905	0.075
Hamilton	39-061-0040	0.0844	0.918	0.077
Warren	39-165-0006**	0.0880	0.878	0.077
Warren	39-165-0007	0.0880	0.878	0.077

* This monitor was discontinued after the 2005 ozone season.
**This monitor was discontinued after the 2003 ozone season and became 0007 in 2004.

In comparison to the respective DVF values found in Table 2-2, the DVF values in Table 3.1-1 are slightly lower at each monitoring site. These differences were expected as 2002 was an abnormally hot and dry year throughout the Southeast resulting ozone concentrations that were higher than normal and that were much higher than in the surrounding years of 2000, 2001, 2003, and 2004. Thus, the recommended DVB calculation weighted these abnormally high air quality conditions several times more than in the KYDAQ alternative DVB calculations. For this reason, the KYDAQ firmly believes that the non-weighted or straight five-year average approach to the DVB calculation is more appropriate and minimizes dramatic fluctuations in meteorological and air quality conditions from year to year.

Using this alternative calculation, none of the monitoring sites in the Cincinnati-Hamilton OH-KY-IN region had DVF values at or above the cutoff point of 82 ppb in Table 3.1-1.

2.3 Air Quality Modeling Results From Other Studies

Another recommended weight of evidence analysis is to review other air quality modeling results that included the Cincinnati-Hamilton OH-KY-IN nonattainment area to determine how other modeling results compare to the attainment demonstration. There are two air quality modeling studies to which results are available for the Cincinnati-Hamilton OH-KY-IN area.

Ohio and Indiana Modeling

Additional air quality modeling that encompassed the Cincinnati-Hamilton OH-KY-IN 8-hour Ozone Nonattainment Area was performed by the Midwest Regional Planning Organization

(MRPO) for both the Indiana and Ohio attainment demonstration submittals. The MRPO is made up of the five Midwest states (Illinois, Indiana, Michigan, Ohio and Wisconsin) and the Lake Michigan Air Directors Consortium (LADCO).

The air quality model selected for this technical analysis was CAMx (version 4.30), an Eulerian photochemical grid model developed by ENVIRON and approved by US EPA for this use. CAMx allows for integrated "one-atmosphere" assessment of ozone and Pm2.5. More notable features of CAMx include flexi-nesting, which allows for reconfiguration of nested grids within the model, multiple gas phase chemistry mechanism options, Plume-in-Grid (PiG) and Ozone Source Apportionment Technology. CAMx modeling is performed on a Linux computing platform with a Portland Group (PGI) FORTRAN compiler to create executable files.

After the 2002 base episodes were modeled and determined to be within accuracy parameters, several future-year exercises were performed such as projecting emissions to 2008 and 2009 and modeling the projected emission reductions from national, regional and local control measures that are in effect or considered "on the books". This includes the NO_x SIP Call and Clean Air Interstate Rule (CAIR) as well as the latest gasoline and engine control measures.

Table 5.3 shows the results of the 2008 modeling and illustrates that all monitored areas in the Cincinnati nonattainment area will attain the NAAQS with the exception of the Hamilton County, OH ozone monitor (monitor ID 390610006).

Table 2.3-1 LADCO Round 4 Modeling for Cincinnati Nonattainment Area Modeled Attainment Year 2008

Monitor	**County**	**AVGDV**	**RRF**	**FYDV**
		(ppm)		(ppm)
3901700041	Butler	.089	0.93	0.083
3901710043	Butler	.087	0.922	0.080
3902500221	Clermont	.089	0.928	0.082
3902710021	Clinton	.094	0.900	0.084
3906100061	Hamilton	.090	0.946	0.085
3906100101	Hamilton	.085	0.925	0.079
3906100401	Hamilton	.086	0.944	0.081
3916500061	Warren	.087	0.921	0.080
2101500031	Boone	.083	0.901	0.075
2103700031	Campbell	.090	0.934	0.084
2111700071	Kenton	.085	0.925	0.078

Further modeling shows that the area will attain the standard (future year value below 0.085 ppm) in 2009 and continue to maintain the standard thereafter. Table 5.3.2-3 shows the results

of the 2009 modeling and illustrates that all monitored areas in the Cincinnati nonattainment area will attain the NAAQS.

Table 2.3-2 LADCO Round 4 Modeling for Cincinnati Nonattainment Area Modeled Attainment Year 2009

Monitor	County	AVGDV	RRF	FYDV
		(ppm)		(ppm)
3901700041	Butler	0.089	0.919	0.082
3901710043	Butler	0.087	0.910	0.079
3902500221	Clermont	0.089	0.919	0.081
3902710021	Clinton	0.094	0.885	0.083
3906100061	Hamilton	0.090	0.938	0.084
3906100101	Hamilton	0.085	0.915	0.078
3906100401	Hamilton	0.086	0.938	0.080
3916500061	Warren	0.087	0.908	0.079
2101500031	Boone	0.083	0.890	0.074
2103700031	Campbell	0.090	0.928	0.084
2111700071	Kenton	0.085	0.915	0.077

U.S. EPA CAIR Modeling

Another air quality modeling exercise that contained results for the Cincinnati-Hamilton OH-KY-IN nonattainment area is the USEPA's modeling for the Clean Air Interstate Rule (CAIR). The Technical Support Document for the final CAIR, March 2005, provided modeling results with and without the implementation for the CAIR. Differences between the USEPA's modeling and the attainment demonstration are: 1) the meteorology was for 2001, 2) the DVB was the weighted design values the 1999-2003 period and 3) the modeling results were for 2010. These modeling results are listed in the table below.

Table 2.3 Cincinnati-Hamilton OH-KY-IN 8-hour Ozone Nonattainment Area DVFs based on the USEPA's CAIR Modeling

County	DVB (ppb)	DVF (ppb)	
		2010 Base	2010 CAIR
Boone	85.3	73.1	73.1
Campbell	92.5	81.6	81.5
Kenton	86.3	75.7	75.6
Butler	89.0	78.2	78.0
Clermont	90.0	78.1	78.0
Clinton	95.7	81.7	81.4
Hamilton	89.3	78.8	78.6
Warren	92.0	80.2	80.0

The USEPA's results were for the highest monitor in a county where more than one monitor is located. The USEPA's modeling results predicts that the Cincinnati-Hamilton OH-KY-IN nonattainment area should be below the 8-hour ozone standard by 2010. Although this is two years later than the attainment year for the Cincinnati-Hamilton OH-KY-IN area, the USEPA's 2010 CAIR DVFs are very close to what the KYDAQ is showing in the attainment demonstration, and supports weight of evidence that the Cincinnati-Hamilton OH-KY-IN area will attain the 8-hour ozone standard by its attainment year of 2008.

2.4 Air Quality Trends and Additional Reductions in Emissions

Since the 8-hour ozone designation for the Cincinnati-Hamilton OH-KY-IN 8-hour Ozone Nonattainment area, the 8-hour ozone design values have improved significantly. The 2001-2003 design value period had values as high as 0.091 ppm and one out of the three Kentucky monitors in the area was violating the NAAQS. Each year since, the design values have decreased and/or the number of violating monitors in the region has decreased. With the latest design value period, 2004-2006, the highest violating monitor has a value of 86 ppb and there is only one monitor that exceeds the NAAQS (See Table 2.4)

Table 2.4 Design Values (ppm) for the Kentucky Monitors in the Cincinnati-Hamilton OH-KY-IN 8-hour Ozone Nonattainment Area

County	Monitor I.D.	2001-2003	2002-2004	2003-2005	2004-2006
Boone	21-015-0003	0.085	0.080	0.076	0.074
Campbell	21-037-0003*	**0.091**	**0.087**	0.083	*
Kenton	21-117-0007	0.085	0.082	0.078	0.077
Butler	39-017-0004	**0.092**	**0.089**	0.085	0.080
Bulter	39-017-1004	**0.089**	0.085	0.082	0.079
Clermont	39-025-0022	**0.090**	**0.088**	0.083	0.078
Hamilton	39-061-0006	**0.093**	**0.089**	**0.086**	0.082
Hamilton	39-061-0010	**0.087**	**0.086**	0.082	0.080
Hamilton	39-061-0040	**0.087**	0.084	0.082	0.080
Warren	39-165-0006**	**0.091**	**0.089**	****	**
Warren	39-165-0007	**0.091**	**0.089**	**0.087**	**0.086**

* This monitor was discontinued after the 2005 ozone season.
**This monitor was discontinued after the 2003 ozone season and became 0007 in 2004.

There are still significant nitrogen oxides (NOx) emission reductions that are expected between now and the attainment year from the mobile sector. These reductions are the result of Federal motor vehicle and equipment standards for both highway vehicles and off-road equipment. As the older vehicles in the fleet are retired and replaced with newer vehicles meeting the Federal standards, the NOx emissions continue to decrease, even though vehicle miles traveled continue to increase. Similarly, as newer off-road equipment is purchased and older equipment is retired, the NOx emissions see a downward trend.

The utility sector is another source of NOx emission reductions that are expected to occur between now and the attainment year due to the continued effects of the NOx SIP Call as well as the implementation of CAIR.

The combination of the mobile source and utility NOx emission reductions that are expected in the Cincinnati-Hamilton OH-KY-IN area since the end of the 2006 ozone season and before the beginning of the attainment year 2008 is significant. The additional NOx emission reductions in the area should ensure that the Cincinnati-Hamilton OH-KY-IN area will attain the NAAQS by the prescribed attainment year.

2.5 Weight of Evidence Conclusions

The KYDAQ believes that it is better to use a 5-year straight average DVB in the attainment test since it will normalize the effects of meteorology on design values more so than a weighted DVB. Based on the alternative DVF calculated in this section, all of the Cincinnati-Hamilton

OH-KY-IN nonattainment area monitors are predicted to be below the 8-hour ozone NAAQS in 2008.

The observed air quality trends in conjunction with further NOx emission reductions expected in the Cincinnati-Hamilton OH-KY-IN area strengthens the argument that the attainment demonstration is an acceptable demonstration.

The KYDAQ believes that the weight of evidence provided in this section is strong evidence that the Cincinnati-Hamilton OH-KY-IN nonattainment area will attain the 8-hour ozone NAAQS by 2008.

Table 2.1-1

County	Sector	Annual Em (Tons) 2008			Annual Em (Tons) 2009			TPD2009 (Typical Summer Day)			TPD/Annual 2009			Calculated 2008 (Typical Summer Day)		
Boone, KY		**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**
	Area	3103.52	1353.87	1944.17	3156.08	1312.34	1925.70	8.25	2.04	5.27	0.002614	0.0015545	0.0027367	8.50	3.71	5.33
	Nonroad	1473.85	18935.34	3799.70	1441.19	19233.00	3768.30	4.18	56.61	11.25	0.00290	0.0029434	0.0029854	4.04	51.88	10.41
	Onroad	4684.63	41711.44	3765.79	4302.24	40469.82	3476.54	3.9		7.99	0.0020152	0.0022748	0.0030375	3.78		8.09
	Point	913.81	571.70	4746.90	912.80	520.80	1405.10	2.51	1.45	2.43	0.0027498	0.0027842	0.0017294	2.50	1.57	13.01
Campbell, KY		**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**
	Area	1704.90	897.57	559.07	1691.58	847.39	544.16	3.89	0.56	1.33	0.00230	0.0006609	0.0024441	4.67	2.46	1.53
	Nonroad	401.53	5005.73	1841.68	385.49	5050.98	1822.96	1.09	15.04	5.30	0.0028276	0.0029776	0.0029074	1.10	13.71	5.05
	Onroad	2843.46	24204.30	1825.62	2631.25	23701.74	1704.58	2.18		4.48	0.0020371	0.0023104	0.0030917	2.27		4.85
	Point	203.00	159.40	61.40	205.80	162.40	62.50	0.57	0.45	0.17	0.0027697	0.0027709	0.00272	0.56	0.44	0.17
Kenton, KY		**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**
	Area	3049.24	1605.16	1628.32	3036.11	1522.78	1603.69	7.10	1.27	4.18	0.00234	0.00083	0.00261	8.35	4.40	4.46
	Nonroad	612.09	11324.92	2573.29	586.83	11467.25	2539.09	1.68	34.31	7.66	0.00286	0.00299	0.00302	1.68	31.03	7.05
	Onroad	6038.43	48728.01	3529.13	5522.56	47210.84	3260.36	3.69		7.67	0.00204	0.00233	0.00310	3.86		8.42
	Point	288.70	16.30	21.30	292.90	16.40	21.50	0.81	0.05	0.06	0.00277	0.00305	0.00279	0.79	0.04	0.06
Butler,OH		**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**
	Area	4,007.39	1,264.57	907.95	4,165.04	1,261.34	912.75	11.07	0.84	1.20	0.00266	0.00067	0.00131	10.98	3.46	2.49
	Nonroad	1,399.26	28,380.00	2,931.42	1,331.94	28,512.43	2,844.44	5.07	114.46	12.52	0.00381	0.00401	0.00440	3.83	77.75	8.03
	Onroad	3,446.42	44,386.59	4,514.96	3,195.99	43,068.21	4,135.03	7.08		14.56	0.00229	0.00198	0.00301	7.79		15.55
	Point	1,093.30	22,964.60	5,066.50	1,089.83	22,714.32	5,031.49	2.99	61.80	14.23	0.00274	0.00272	0.00283	3.00	62.92	13.88
Clermont, OH		**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**
	Area	2,228.71	1,552.88	602.05	2335.90	1543.81	604.92	6.22	0.70	0.84	0.00266	0.00045	0.00139	6.11	4.25	1.65
	Nonroad	883.23	14,746.99	1,376.14	846.79	14827.37	1329.98	3.24	60.32	6.16	0.00383	0.00407	0.00463	2.42	40.40	3.77
	Onroad	2,001.11	26,869.08	3,012.58	1857.62	26047.64	2754.27	4.82		9.92	0.00227	0.00200	0.00298	5.46		10.90
	Point	244.30	2,065.80	23,991.80	223.06	1894.52	14283.63	0.73	6.19	46.79	0.00327	0.00327	0.00328	0.67	5.66	65.73
Clinton, OH		**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**
	Area	928.43	624.27	161.13	1,034.10	619.54	161.82	2.80	0.17	0.20	0.00271	0.00027	0.00124	2.54	1.71	0.44
	Nonroad	419.36	3,643.91	783.32	410.93	3,658.99	767.10	1.52	13.67	2.97	0.00370	0.00374	0.00387	1.15	9.98	2.15
	Onroad	541.47	8,022.73	920.55	499.06	7,668.76	835.78	1.81		2.63	0.00212	0.00202	0.00293	2.41		4.17
	Point	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hamilton, OH		**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**
	Area	11,116.07	2,435.25	3,014.92	11,469.38	2,443.62	3,031.86	30.56	2.96	3.92	0.00266	0.00121	0.00129	30.45	6.67	8.26
	Nonroad	3,539.68	71,592.30	5,677.09	3,369.56	71,999.10	5,465.85	12.62	280.05	23.46	0.00375	0.00389	0.00429	9.70	196.14	15.55
	Onroad	10,394.50	142,887.51	13,446.96	9,645.29	138,631.38	12,306.73	20.38		42.02	0.00230	0.00199	0.00302	22.36		45.16
	Point	455.50	2,247.50	16,598.80	424.67	2,019.47	8,388.62	1.22	6.07	25.83	0.00287	0.00301	0.00308	1.25	6.16	45.48
Warren, OH		**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**

Table 2.1-1

County	Sector	Annual Em (Tons) 2008			Annual Em (Tons) 2009			TPD2009 (Typical Summer Day)			TPD/Annual 2009			Calculated 2008 (Typical Summer Day)		
	Area	2,323.71	1,027.93	576.11	2,474.91	1,023.96	579.01	6.61	0.66	0.85	0.00267	0.00064	0.00147	6.37	2.82	1.58
	Nonroad	1,007.81	15,866.35	1,720.42	967.43	15,890.11	1,645.91	3.82	65.89	8.38	0.00395	0.00415	0.00509	2.76	43.47	4.71
	Onroad	1,655.82	22,558.31	2,484.91	1,537.23	21,872.97	2,269.82	5.63		11.58	0.00227	0.00199	0.00297	5.93		11.83
	Point	95.20	278.60	765.30	96.48	279.64	766.44	0.27	0.78	2.09	0.00280	0.00279	0.00273	0.26	0.76	2.10
Dearborn, IN		**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**	**VOC**	**CO**	**NOx**
	Area	774.77	656.36	151.99	780.21	648.02	152.48	1.70	0.39	0.23	0.00218	0.00060	0.00151	2.12	1.80	0.42
	Nonroad	190.49	2,904.28	463.28	183.91	2,927.68	458.93	0.63	11.42	1.67	0.00343	0.00390	0.00364	0.52	7.96	1.27
	Onroad	1,655.82	22,558.31	2,484.91	1,537.23	21,872.97	2,269.82	0.73		1.06	0.00227	0.00199	0.00297	0.72		1.09
	Point	1,027.10	1,313.30	15,057.80	1,047.14	1,312.31	9,261.80	2.46	4.03	29.80	0.00235	0.00307	0.00322	2.81	3.60	41.25

Table 2.1-2 (Typical Summer Day)

Boone, KY	**VOC 2008**	**CO 2008**	**NOx 2008**	**VOC 2009**	**CO 2009**	**NOx 2009**	**%Diff VOC**	**ABS Diff VOC**	**%Diff CO**	**ABS Diff CO**	**%Diff NOx**	**ABS Diff NOx**
Area	8.50	3.71	5.33	8.25	2.04	5.27	-2.94%	0.25	-45.01%	1.67	-1.13%	0.06
Nonroad	4.04	51.88	10.41	4.18	56.61	11.25	3.47%	0.14	9.12%	4.73	8.07%	0.84
Onroad	3.78		8.09	3.9		7.99	3.17%	0.12		0.00	-1.24%	0.10
Point	2.50	1.57	13.01	2.51	1.45	2.43	0.40%	0.01	-7.64%	0.12	-81.32%	10.58
Subtotal	**18.82**	**57.16**	**36.84**	**18.84**	**60.10**	**26.94**	**0.11%**	**0.02**	**5.14%**	**2.94**	**-26.87%**	**11.58**
Campbell, KY	**VOC 2008**	**CO 2008**	**NOx 2008**	**VOC 2009**	**CO 2009**	**NOx 2009**	**%Diff VOC**	**ABS Diff VOC**	**%Diff CO**	**ABS Diff CO**	**%Diff NOx**	**ABS Diff NOx**
Area	4.67	2.46	1.53	3.89	0.56	1.33	-16.70%	0.78	-77.24%	1.90	-13.07%	0.20
Nonroad	1.10	13.71	5.05	1.09	15.04	5.3	-0.91%	0.01	9.70%	1.33	4.95%	0.25
Onroad	2.27		4.85	2.18		4.48	-3.96%	0.09		0.00	-7.63%	0.37
Point	0.56	0.44	0.17	0.57	0.45	0.17	1.79%	0.01	2.27%	0.01	0.00%	0.00
Subtotal	**8.60**	**16.61**	**11.60**	**7.73**	**16.05**	**11.28**	**-10.12%**	**0.87**	**-3.37%**	**0.56**	**-2.76%**	**0.32**
Kenton, KY	**VOC 2008**	**CO 2008**	**NOx 2008**	**VOC 2009**	**CO 2009**	**NOx 2009**	**%Diff VOC**	**ABS Diff VOC**	**%Diff CO**	**ABS Diff CO**	**%Diff NOx**	**ABS Diff NOx**
Area	8.35	4.40	4.46	7.1	1.27	4.18	-14.97%	1.25	-71.14%	3.13	-6.28%	0.28
Nonroad	1.68	31.03	7.05	1.68	34.31	7.66	0.00%	0.00	10.57%	3.28	8.65%	0.61
Onroad	3.86		8.42	3.69		7.67	-4.40%	0.17		0.00	-8.91%	0.75
Point	0.79	0.04	0.06	0.81	0.05	0.06	2.53%	0.02	25.00%	0.01	0.00%	0.00
Subtotal	**14.68**	**35.47**	**19.99**	**13.28**	**35.63**	**19.57**	**-9.54%**	**1.40**	**0.45%**	**0.16**	**-2.10%**	**0.42**
KY Total	**42.10**	**109.24**	**68.43**	**39.85**	**111.78**	**57.79**	**-5.34%**	**2.29**	**2.33%**	**3.66**	**-15.55%**	**12.32**
Butler, OH	**VOC 2008**	**CO 2008**	**NOx 2008**	**VOC 2009**	**CO 2009**	**NOx 2009**	**%Diff VOC**	**ABS Diff VOC**	**%Diff CO**	**ABS Diff CO**	**%Diff NOx**	**ABS Diff NOx**
Area	10.98	3.46	2.49	11.07	0.84	1.20	0.82%	0.09	-75.72%	2.62	-51.81%	1.29
Nonroad	3.83	77.75	8.03	5.07	114.46	12.52	32.38%	1.24	47.22%	36.71	55.92%	4.49
Onroad	7.79		15.55	7.08		14.56	-9.11%	0.71		0.00	-6.37%	0.99
Point	3.00	62.92	13.88	2.99	61.80	14.23	-0.33%	0.01	-1.78%	1.12	2.52%	0.35
Subtotal	**25.60**	**144.13**	**39.95**	**26.21**	**177.10**	**42.51**	**2.38%**	**0.61**	**22.88%**	**32.97**	**6.41%**	**2.56**

Table 2.1-2 (Typical Summer Day)

Clermont, OH	**VOC 2008**	**CO 2008**	**NOx 2008**	**VOC 2009**	**CO 2009**	**NOx 2009**	**%Diff VOC**	**ABS Diff VOC**	**%Diff CO**	**ABS Diff CO**	**%Diff NOx**	**ABS Diff NOx**
Area	6.11	4.25	1.65	6.22	0.70	0.84	1.80%	0.11	-83.53%	3.55	-49.09%	0.81
Nonroad	2.42	40.40	3.77	3.24	60.32	6.16	33.88%	0.82	49.31%	19.92	63.40%	2.39
Onroad	5.46		10.90	4.82		9.92	-11.72%	0.64		0.00	-8.99%	0.98
Point	0.67	5.66	65.73	0.73	6.19	46.79	8.96%	0.06	9.36%	0.53	-28.81%	18.94
Subtotal	**14.66**	**50.31**	**82.05**	**15.01**	**67.21**	**63.71**	**2.39%**	**0.35**	**33.59%**	16.90	**-22.35%**	**18.34**
Clinton, OH	**VOC 2008**	**CO 2008**	**NOx 2008**	**VOC 2009**	**CO 2009**	**NOx 2009**	**%Diff VOC**	**ABS Diff VOC**	**%Diff CO**	**ABS Diff CO**	**%Diff NOx**	**ABS Diff NOx**
Area	2.54	1.71	0.44	2.80	0.17	0.20	10.24%	0.26	-90.06%	0.00	-54.55%	0.24
Nonroad	1.15	9.98	2.15	1.52	13.67	2.97	32.17%	0.37	36.97%	0.06	38.14%	0.82
Onroad	2.41		4.17	1.81		2.63	-24.90%	0.60		0.72	-36.93%	1.54
Point	0.00	0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00
Subtotal	**6.10**	**11.69**	**6.76**	**6.13**	**13.84**	**5.80**	**0.49%**	**0.03**	**18.39%**	**0.66**	**-14.20%**	**0.96**
Hamilton, OH	**VOC 2008**	**CO 2008**	**NOx 2008**	**VOC 2009**	**CO 2009**	**NOx 2009**	**%Diff VOC**	**ABS Diff VOC**	**%Diff CO**	**ABS Diff CO**	**%Diff NOx**	**ABS Diff NOx**
Area	30.45	6.67	8.26	30.56	2.96	3.92	0.36%	0.11	-55.62%	3.71	-52.54%	4.34
Nonroad	9.70	196.14	15.55	12.62	280.05	23.46	30.10%	2.92	42.78%	83.91	50.87%	7.91
Onroad	22.36		45.16	20.38		42.02	-8.86%	1.98		0.00	-6.95%	3.14
Point	1.25	6.16	45.48	1.22	6.07	25.83	-2.40%	0.03	-1.46%	0.09	-43.21%	19.65
Subtotal	**63.76**	**208.97**	**114.45**	**64.78**	**289.08**	**95.23**	**1.60%**	**1.02**	**38.34%**	80.11	**-16.79%**	**19.22**
Warren, OH	**VOC 2008**	**CO 2008**	**NOx 2008**	**VOC 2009**	**CO 2009**	**NOx 2009**	**%Diff VOC**	**ABS Diff VOC**	**%Diff CO**	**ABS Diff CO**	**%Diff NOx**	**ABS Diff NOx**
Area	6.37	2.82	1.58	6.61	0.66	0.85	3.77%	0.24	-76.60%	0.00	-46.20%	0.73
Nonroad	2.76	43.47	4.71	3.82	65.89	8.38	38.41%	1.06	51.58%	0.10	77.92%	3.67
Onroad	5.93		11.83	5.63		11.58	-5.06%	0.30		1.37	-2.11%	0.25
Point	0.26	0.76	2.10	0.27	0.78	2.09	3.85%	0.01	2.63%	0.00	-0.48%	0.01
Subtotal	**15.32**	**47.05**	**20.22**	**16.33**	**67.33**	**22.90**	**6.59%**	**1.01**	**43.10%**	**1.27**	**13.25%**	**2.68**
Ohio Total	**125.44**	**462.15**	**263.43**	**128.46**	**614.56**	**230.15**	**2.41%**	**2.03**	**32.98%**	**14.11**	**-12.63%**	**65.33**

Table 2.1-2 (Typical Summer Day)

Dearborn, IN	VOC 2008	CO 2008	NOx 2008	VOC 2009	CO 2009	NOx 2009	%Diff VOC	ABS Diff VOC	%Diff CO	ABS Diff CO	%Diff NOx	ABS Diff NOx
Area	2.12	1.80	0.42	1.70	0.39	0.23	-19.81%	0.42	-78.33%	1.41	-45.24%	0.19
Nonroad	0.52	7.96	1.27	0.63	11.42	1.67	21.15%	0.11	43.47%	3.46	31.50%	0.40
Onroad	0.72		1.09	0.73		1.06	1.39%	0.01		0.00	-2.75%	0.03
Point	2.81	3.60	41.25	2.46	4.03	29.80	-12.46%	0.35	11.94%	0.43	-27.76%	11.45
Subtotal	**6.17**	**13.36**	**44.03**	**5.52**	**15.84**	**32.76**	**-10.53%**	**0.65**	**18.56%**	2.48	**-25.60%**	**11.27**
Nonattainment Total	**173.71**	**584.75**	**375.89**	**173.83**	**742.18**	**320.70**	**0.07%**	**4.50**	**26.92%**	**21.44**	**-14.68%**	**55.19**